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European distribution systems with the light on logistic effectiveness

The case of Radi Medical Systems

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Abstract

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When consumers are asking for more and more products available, to a lower price and with better service the distribution of goods is growing in importance. This thesis has addressed three strategies for distribution from one company to its customers within Europe. The aim is to see how these different distribution strategies perform in terms of logistic efficiency. With starting point in theories outlined by Abrahamsson et al three different strategies, decentralized, centralized and income generating distribution has been outlined. Thereafter the strategies were mapped in terms of costs associated to the distribution, capital sitting in inventory and service towards the customers. To support the theoretical findings a case study has been conducted at a medical device company. The two first strategies were then evaluated in close relation to the case study company where a change from decentralized to centralized distribution was implemented during the time for the thesis. The previous decentralized distribution system was replaced by a centralized direct distribution system, both systems described and discussed in the thesis. In broad there are advantages in number of units in stock and service to the customers when shifting from decentralized to centralized distribution. From the case study an unexpected increase in distribution cost was observed but it is derived back to the position of the central warehouse. With the outcomes from these two stages and theoretical framework the third, income generating distribution system was outlined along with recommendations how to turn logistics into an income generating department. The main objective in order to reach the income generating stage has to be a broad sense for customer service.

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Populärvetenskaplig sammanfattning

Utifrån dagens ständigt ökande tillgång av varor från hela världen ställs det allt högre krav på hur varor och produkter distribueras. Kunderna utgår från att varor de söker finns tillgängliga när de behöver dem oavsett vart de tillverkas. Företagens utmaning i detta scenario är att kunna tillgodose kundernas önskemål samtidigt som kostnaderna för att hantera och flytta varorna inte blir för höga samt att lagren av varor inte blir för stora och dyra att behålla.

Denna problematik är inte isolerad till någon enskild bransch utan gäckar företag över hela världen och utmanar dem till att ständigt förbättra deras arbete med distributionen inom företagen. Sjukvården är ett område som har lång väg kvar innan de kan mäta sig med den effektivitet som finns inom detaljhandeln men det sker många spännande satsningar för att förbättra även denna bransch.

Denna uppsats har studerat tre olika typer av distributionssystem utifrån hur effektiva de är med avseende på kund, kostnad och lager. Systemen omfattar de händelser som uppstår från att en produkt är färdig för försäljning till dess att den är levererad till kunden. Studien har genomförts genom aktuell litteratur inom området samt vid Radi Medical Systems som levererar sina produkter till sjukhus och kliniker runt om i världen. Fokus har varit på deras europeiska distribution där en förändring från ett decentraliserat till ett centraliserat distributionssystem har genomförts. Dessa två system har kartlagts och utvärderats. Det har sedan utgjort grunden för hur ett framtida arbete med distribution skulle kunna komma att se ut.

De resultat som har kommit fram i studien pekar på att det finns stora fördelar i att gå från ett decentraliserat till ett centraliserat distributions system. Det ska dock poängteras att kostnaden för transporterna steg i det aktuella fallet. Detta ses som en konsekvens av placeringen av centrallagret. Avslutningsvis vad gäller framtida distributionsarbete kan det sägas att en ökad kundanpassning driver utvecklingen mot nya distributions system, utan att kostnaderna för distributionen eller lagren behöver öka.

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1 Introduction

Imagine one day at the supermarket, as soon as one plans the weekly purchase it is taken for granted that the goods and products are available in the store. If something is missing a person finds it annoying that the products are not there, regardless of the origin or type of goods the customer expects it to be available. For example fresh fruit is sourced from the opposite side of the globe on a regular basis today with customers demanding the goods in stock every day. With flows like these the pressure on the distribution systems both in terms of quality of and cost for the service is high.

Global world leaders in terms of distribution are assembling products from customer orders within hours without having raw material in their inventory and then delivered seven days later to the end customer. Other companies have service agreements providing spare parts world wide within 48 hours from one single warehouse, not only into the countries but also to rural cities in the countries are supplied this way. In the early 90s' Abrahamsson (1993) described a direct distribution system from one warehouse to all customers in Europe. There are though branches where the evolution of the distribution systems in general has not reached that far. The healthcare industry is as McKone-Sweet, Hamilton and Willis (2005) present in their paper slow to embrace the opportunities and possibilities that comes from an efficient utilization of products and resources. An increasing number of classes and speeches directing the topic of effectiveness within the healthcare area can be seen as a token for improvement within the field. The awareness of issues as productivity and lean thinking is increasing in the healthcare industry (Valcon, 2007).

In the healthcare industry one can find Radi Medical Systems AB who supplies hospitals and clinics with advanced medical devices. The company has decided to challenge their old structures and is at present engaging in a large logistical challenge. Radi Medical Systems is a global medical device company based in Uppsala. The company is facing a change in their European distribution structure. The structure of today will be replaced with a new distribution system which focuses on direct distribution to the end customer, from one warehouse to all of Europe.

1.1 Aim with the thesis

The aim for this thesis is to see how different distribution system perform in terms of logistic effectiveness i.e. distribution cost, tied up capital and customer service.This will be carried through as a case study on a company in the healthcare industry, Radi Medical Systems.

The following questions will be treated in this thesis:

1. How has the work with distribution at Radi Medical Systems been organized during the first years of the 21st century and how has it performed in terms of logistic effectiveness?

2. How could a centralized distribution system at Radi Medical Systems perform in relation to the statements done in the theoretical framework?
3. Which lessons can be drawn from the study of Radi Medical Systems and present research when companies want to develop their distribution system in order to meet future challenges?

1.2 Delimitations

At the company only the European distribution system has been included in order to delimit the study to a clear scope. In Europe only the markets where Radi Medical Systems have their own subsidiaries have been investigated since those markets are the only that are controlled by Radi Medical Systems and not an independent distributor.

1.3 Disposition

The essay is split up in 7 chapters, all contributing to answer the aim for this thesis.

In chapter 2 a theoretical framework consisting of two parts is outlined. First it treats the term logistic effectiveness with the constructs distribution costs, tied up capital and customer service and thereafter follows a description of different distribution systems.

Chapter 3 outlines the methods used in the work with the thesis, both how the information is gathered and how the material thereafter is analysed.

Chapter 4 introduces the empirical material from the case study company. A general overview of the company Radi Medical Systems is presented and then the distribution system targeted by sub question 1 is being discussed in more detail.

Chapter 5 presents the new distribution system introduced at the case study company. The chapter handles how the centralized distribution system performs in relation to the theories around logistic effectiveness as sub question 2 is directing.

In the sixth chapter the thesis outlines how the future work with distribution can be carried through. Chapter 6 is summarizes the theoretical framework and the learning's from the case study company in the two previous chapters. These two pillars are then used to answer the third sub question in the aim for the thesis.

In the conclusion in chapter 7 the thoughts around the aim of the thesis will be consolidated and finalized, the thesis will also be highlighted in relation to a broader context and recommendations for further studies will be presented.

Finally the last chapter, number 8, will list the literature and sources used in this thesis. Thereafter follows the appendixes containing both a scheme for the interviews and a summary of different key figures in the thesis.

2 Logistic effectiveness and distribution systems

In this chapter the theoretical framework that constitutes the base for future analytical conclusions in this thesis is outlined. The first part will address the issues around how logistic effectiveness can be observed and studied. The second part of the theoretical framework outlines theories around the evolution of different distribution systems.

2.1 Logistic effectiveness

One way of evaluating logistic performance is according to Lumsden (2006) to evaluate the three parts of the logistic effectiveness. The basic concept is that there are three ways that logistics can have an impact on the overall performance of a company; through reducing costs in association to logistics, by reducing the levels of capital tied up in inventory or by improving the customer service. These three parameters are closely interrelated with each other, meaning that a reduction in transportation costs often brings an increase in inventory levels. When for example the number of shipments becomes fewer and fewer the amount of goods in each shipment has to increase in order to maintain the same customer service. This change into larger shipments makes the level of inventory increase and the cost for the transportation decreases. Another example is shortage of products, then customers can be compensated with express delivery increasing distribution cost or the levels of inventory can be increased building up the tied up capital or the customer can get compensation in terms of discounts given on the customer service behalf. These parameters have to be monitored simultaneously in order to prove an improvement with a change in the logistic system.

Jonsson & Mattsson (2005) are supporting Lumsden logistic effectiveness in their book. They use the three basic constructs; distribution costs, tied up capital and customer service as the variables that have an impact on the overall effectiveness of the logistics. The authors also present parameters that are indirect affecting the over all effectiveness, namely agility, time and environment issues. Agility refers to the capacity of the logistic system to adapt to changed business conditions e.g. react on an increased demand of products. Time is crucial in the world of logistics; delivery precision and delivery time are some of the areas where time is part of the logistic effectiveness. The environment issues are affecting all different parts of the logistics process. Different parties, such as customers or governments are applying different demands for change in environment issues.

This thesis is focusing upon the distribution of goods to end customers and will therefore present the three constructs in logistic effectiveness within a distribution context. The different parameters are related to each other which make them difficult to separate. The upcoming part will outline the parameters and the methodology chapter will address the adoption of them in this thesis.

2.1.1 Distribution cost

In the basic model Lumdsen refers to logistic cost as one component in logistic effectiveness, here entitled distribution costs. This in order to include the costs related to the specific area of interest instead of a general approach. The three basic parameters of distribution cost are mentioned by Lumsden (2006); handling, transportation and control costs.

- Handling costs include the personal processing orders from the time a customer places an order until it is ready for delivery. This also includes the cost for renting storage area and the work that occurs around the stock area in terms of moving and packing the goods.
- Transportation costs include the cost for the actual transportation. Both schedule transports that are planned in advance and express freights that are used to solve an emergency situation at some place.
- The cost for control includes administrative personal and investments in information systems that are needed to monitor the whole distribution process.

Jonsson and Mattsson (2005) highlights the cost for shortage or delays as one closely related to distribution. If a product is unavailable when a customer demands it, two different scenarios are possible, either a need for express delivery or an unsatisfied customer. The problem of shortage is an example where it is problematic to separate the three constructs and find one construct being more affected than the others.

2.1.2 Tied up capital

Tied up capital is the term for capital being locked up in inventory instead of being available to invest into other opportunities. Instead of being available to other investments the capital is tied up in raw material, work in process or finished goods, all different types of inventory. Raw material is prior to the production has started. When the material enters the production process it turns into work in progress. When the products are leaving the production cycle they become finished goods and available for customers. (Lumsden 2006) Since this thesis addresses the question of distribution it focuses upon finished goods rather than the other two types of inventory. Finished goods include the goods from time it has been released from production until it has been delivered to the end customers. The goods can be stored in warehouses or be goods in transit. (Jonsson and Mattsson 2005)

2.1.3 Customer service

In Ballou (2004) the author divides the elements of customer service into categories depending on when they occur in relation to the transaction with the customer i.e. pretransaction, transaction and post-transaction elements. The pretransaction period consist of the establishing of a customer relation, communicating agreements and statements of the companies policies and requirements. During the transaction period the customer service decisions have an impact on the delivery of the product e.g. stock levels, selection of transport mode and the order process. This has implications on the availability of goods, the quality of the delivery much more. In the third phase of customer service events happening after the actual transaction appears for example product tracking, installations and support. The total performance in the three stages states the overall customer service of a company according to Ballou..

Different elements of customer service are addressed in some detail in Lumsden (2006). Delivery precision refers to the ability of a company to deliver according to set times and agreements. The delivery precision can be measured in different ways between companies. Jonsson & Mattsson (2005) points out that delivery precision preferably is used in relation to products produced on order from a customer and not on goods that is delivered from a stock.

Availability or service level tells to what extent ordered goods can be delivered directly from stock to a customer. This measurement is more appropriate for companies delivering from an inventory to the customers. (Lumsden 2006) Availability can be assessed in different ways according to Jonsson & Mattsson (2005). The availability is monitored as a percentage of goods delivered directly from stock. The figures depend upon whether one studies complete orders or each individual order line upon that order. In the later example the figures increase since some order lines can be met without meeting the whole order from the stock. Tracey (1998) highlights a problem with availability and fill rates since there are a competition between providing sufficient inventory levels in order to serve customers and to reduce the tied up capital caused by the inventory levels.

Lead time is a measurement of the time from an order is placed until the goods reach the customer. Lead time is measured from a customer perspective and has therefore little interest in what happens during the lead time. To a customer the crucial task is to get the ordered goods to the address in time. (Lumsden 2006) In Tracey (1998) a broader perspective of lead time is used referred to the time from an early idea to a product ready for the market.

Information exchange between the customer and the company is important in the daily business today. The information flow stretches from what a company can offer via what customers need to what the customer actual is getting. In this communication between the company and the customer exceptions from the norm can be communicated. (Lumsden 2006) Also Tracey (1998) addresses order information as an important part of customer service since access to information such as availability and delivery date is crucial for customers today and made possible by efficient logistical networks

Tracey (1998) outlines different areas in his paper around customer service in relation to distribution. Some of the issues are presented above and the remaining will follow below. The paragraphs presented by Tracey are attached to both customer service as well as the other constructs distribution cost and tied up capital and highlights the interconnection between the different constructs. The paragraphs are:

- Price offered – the end price will be affected by the costs for transportation that has occurred during the manufacturing
- Quality of products – the quality of a product is depending on things such as package, storage and handling on its way to customers
- Product variety – in order to serve customers with an extended assortment, the distribution functions have to be appropriate both during manufacturing and towards customers with no extended increase of inventory
- Delivery frequency – to meet a requirement from customers of increased shipments the logistics have to meet this without increasing the cost of transports too much.

In Ballou (2006) the author discusses a concept called logistic customer service and the problem of estimating the impact of profit generated by improved logistic customer service. Logistic customer service includes the performance of the process that is delivering finished goods to the customers. As a consequence of that the logistic customer service has several different dimensions how it can make an impact on the end customer. The problem according to Ballou is that the impact from logistic customer service on sales and profit is difficult to measure and therefore top management is hard to convince. They find it easier to target cost reduction rather than revenue making with logistics.

Lumsden (2006) is handling customer service in his book in a way that aligns well with the purpose of this thesis. The author highlights a close connection between the marketing department and the logistic department in the work around customer service. Lumsden defines the part of customer service connected to a physical flow of goods as delivery service. This thesis will share the same definition as Lumsden but use the term customer service.

2.2 Introduction to distribution logistics

When addressing logistic issues a central concept is the supply chain. The supply chain is a gathering name for all involved participants in a products life, from the supplier of the raw material to the final consumer. Mentzer et al (2001) is in there work presenting a definition of a supply chain as a set of three of more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer. It can be visualized by a chain of entities that are related to each other via the different flow mentioned above, foremost products. The distribution system is what Mentzer et al (2001) refers to as the downstream flow of a product. Heikkilä (2002) discusses a model around demand chain management build upon the same base as the supply chain management. The difference is an increased focus on the needs from the marketplace and to design the chain from the end-customers point of view rather than build up around supplier/manufacturer relations.

2.3 Distribution systems

In the field of distribution theories Abrahamsson et al (2003) argues that there are three different types of distribution platforms available for manufacturing companies. The three types represent the evolvement of distribution platforms over time, from a decentralized logistic organization to an integrated cross functional approach. These three platforms towards logistic distribution are all designed for the same main purpose to deliver goods but differ in their set up how to carry through the task.

2.3.1 Type 1 – Decentralised Logistics

The basics, described by Abrahamsson et al (2003), for the decentralised distribution system is a decentralised organization with a high level of sovereignty in the different parts of the distribution chain. The logistic function in these cases is either related to production or to marketing based on the objectives for the company. In a big company this applies to a high number of independent warehouses and distribution points with self managed stock levels and re ordering points. When adding an extra subsidiary to the company there will also be an extra distribution model for the specific area. In Abrahamsson (1993) three big companies logistics platforms in Europe are described. In all cases the local sales companies are spread out over most of Europe with at least one own managed warehouse locally. The strategy was to have the finished goods geographically close to the customers.

2.3.2 Type 2 – Centralised Logistics

In type 2 Abrahamsson et al (2003) describes a structure where the physical distribution is centralised and separated organizationally from other departments such as sales or production. The driving forces behind entering type 2 are total logistic cost, economy of scale, product availability and order lead time. In order to achieve the direct distribution the

responsibility and design of logistics and IT have to be centralised. The type 2 focuses on internal performance and have low integration with other parts of the supply chain.

The type 2 distribution system is described by Abrahamsson (1993) when he discusses the term time-based distribution. Time-based distribution changes focus for the distribution from being geographically close to the customers to being able to deliver goods within a specific time, e.g. 24 or 48 hours. The use of time-based distribution is beneficial to both parts of a logistic agreement as described in the table below. The table describes a comparison between a type 1 and a type 2 distribution system. The changes addressed are to be found when switching from type 1 to type 2.

General effects of time based direct distribution in relation to a decentralized distribution system	
Logistic cost leadership	Logistic buyer value
Fixed distribution costs: Decreased cost for personnel, warehouses and administration	Lead times: Shorter and more reliable lead times for all the markets and for all the products
Variable distribution costs: Reduced inventory costs Constant transportation costs	Delivery performance: Increased on-time deliveries Complete orders to the customers
Savings in integration/separation: Sales function separated from the materials flow Centralized control of the materials flow – economies of scale Integrated distribution functions	Differentiation: Customized distribution to different groups of customers Increased flexibility
Savings in learning costs: Faster introduction of new products in the assortment	Customer information: Faster and more reliable information to the customers about discrepancy

Table 1) This table shows the effects from a time based distribution concluded by Abrahamsson in his article. To the left the supplier and to the right the buyers share of benefits. (Abrahamsson 1993)

The introduction of a direct distribution will also render in constant transportation costs and decreased inventory costs. The cases studied by Abrahamsson (1993) shows how the outgoing flow will be smoother when addressing the customers need compared to local warehouses. Together with the increased availability of goods due to the pooling of inventory this will generate reductions in inventory costs and no change in transportation costs. A crucial prerequisite in order to implement time based distribution or type 2 distribution system is a computerized information system, a system that supports order handling and productions planning, enabling remotely placed orders to be processed at a central warehouse.

2.3.3 Type 3 – Logistics Platforms as a Resource Base for Market Development

When Abrahamsson et al (2003) discuss the third type of logistics they see a shift in focus from internal processes towards external integration from raw material producer to end customer. A key is flexibility towards the market and the possibility to use logistics in order to create new market solutions. The new function moves the logistic departments to a equal position as the market department as logistic is contributing to the value to the products This gives the logistic department a more independent position compared to earlier stages of distribution.

The visions and thoughts from type 3 are supported by several authors. An example is Skjoett-Larsen (2000) who highlights seven topics within logistics touching the whole supply chain in his paper. Two of the trends are applicable to distribution systems. New distribution concepts are a support for market developments. This will be more important in the future with higher competitiveness and therefore increased demand of customer-adapted service. Skjoett-Larsen also discusses a separation of physical material flow and information flow within a company. As a consequence of the separation it is possible to have the administrative functions centralized as well. This concept is described by Abrahamsson , Brege and Norrman (1998) where they plot a scenario where a company first centralizes the distribution in line with Type 2 logistics. Thereafter the company centralizes the administrative work in order to achieve economy of scale and increased coordination within the administrative work. Abrahamsson et al (1998) states that in order to fulfil a centralization of the administrative work the information system most be supportive and supply both sales figures and availability of stock to whom it concerns.

In Ballou (2007) the author presents several challenges for the future within distribution systems and related fields. Most of the concluded challenges address the integration between different actors of the supply chain and how those interfaces could be improved and more efficient. There are three of the challenges that touches upon the distribution framework presented by Abrahamsson et al. Firstly the author addresses that supply chain models will be used as a way of generating revenue and secondly the need to divide the profit made in one step of the supply chain to the other participants. The second part is directly applicable to distribution systems with a need for benefit sharing in the supply chain. The benefits from an efficient distribution system have to be shared by the involved parts. Finally, the organizational scheme of a company will be reworked. In the future, issues around logistics and therefore also distribution will be higher up in the organization compared to earlier according to Ballou (2007).

3 Method

In this chapter the method for the thesis is presented. The thesis is divided into stages and how the stages have been carried through and what they have contributed to in the relation to the aim for this thesis is presented. The first parts bring up the literature study and the choice of case study company. Thereafter the collection and presentation of the empirical data is discussed. Finally the adoption of the theoretical framework in this thesis is presented.

3.1 Literature review

Prior to the collection of empirical data a review of articles and theories addressing distribution systems, direct distribution, logistic effectiveness and related areas were conducted. The core of the theoretical framework was the work performed by Abrahamsson around distribution systems. The theories he presents are established and used by professionals and referred to by other authors within the field of distribution. In order to evaluate and compare the different distribution systems the theories around logistic effectiveness were adopted. The logistic effectiveness concept is build up by theories around distribution cost, tied up capital and customer service. The three constructs were chosen since they provided a good overview of the positive and the negative aspects of the different distribution systems. The constructs are as seen in the theoretical framework also closely related to each other and to omit one of them would not be fare to the overall comparison. There were though constructs that were omitted and not used in the analysis of the distribution systems since the aim with the thesis were fulfilled by the use of the three elected constructs.

3.2 Choice of case study company

The aim of this thesis is to investigate how different distribution systems performs in relation to the logistic effectiveness parameters in general with a focus the three parameters distribution cost, tied up capital and customer service. To reach these findings a case study at Radi Medical Systems AB has been conducted.

The case study company, Radi Medical Systems AB decided during 2007 to change their European distribution system. This was in order to switch from a decentralized distribution with local subsidiaries serving their particular market to a centralized system with one warehouse distributing to the whole European market. Therefore I have found that Radi Medical Systems is suitable to be the case in focus in this thesis.

Radi Medical Systems had a total turnover of 450 MSEK in 2007. The company is spread out over the world and their 450 employees are located either at the head quarter in Uppsala or at one of the nine subsidiaries. The company has a global Enterprise resource planning [1]

[1] An ERP system is an integrated computer system handling all data and processes in a company (Jonsson & Mattsson, 2005)

(ERP) system installed at the majority of the subsidiaries including 95 % of the total turnover. The production is focused to the site in Uppsala and the subsidiary in Thailand. All the products sold by the company are also produced by the company. All the goods from the production either from Uppsala or from Thailand passes through the facility in Uppsala before it is distributed to the end customers.

3.3 Data collection

The data collection was based on a strategic decision to gather information regarding the distribution system at Radi Medical Systems. The process of distribution and the different areas affected by the process were studied in depth. How the goods were delivered to the end customers and how this could be improved upon. The choice of respondents and data that was needed from the company was based upon strategic decisions with a focus on distribution issues.

The method for the gathering of the empirical data is what Lorentz (2004) refers to as action research. Lorentz describes a scenario where the researcher is in close relation to the actual study object and both to the planning and the implementation of an improvement work. In this thesis the empirical data is gathered during the fall 2007 when the author was stationed at the case study company. During the period a company project has worked for a new distribution system in Europe with the author as one of the participant. Beside the work with this thesis the author has contributed to the new distribution system with knowledge.

In the project working with this change the author was responsible for the pre study and most of the data gathering in order to build a solid case for the company. In addition to this the author was involved in most of the parts of the project. These tasks provided the author with a broad picture and sense for the problem and performance of the system in reality. This information was used throughout the work with this thesis.

In order to expand the preferences, external input has been gathered from network meetings, conferences and fairs focusing on logistics and distribution questions. For example how the Swedish Apoteket has handled a re-design of their distribution system from decentralized to centralized response for the operations. On top of this experts have been interviewed during the time of the study, both from a company who have done a project similar to the one at Radi Medical Systems and from transport companies. During the time six different transport companies[2] have been consulted in the process of changing distribution patterns. These inputs have given an understanding of the circumstances surrounding a project like this and placed it in a broader context.

[2] The transport companies were CEVA Logistics, DHL, FedEX, TNT, UAE Logistics and UPS

3.4 Respondents and interviews

In order to increase knowledge interviews were conducted with different actors at the case study company. The interviews addressed different aspects of distribution in relation to the constructs of logistic effectiveness. It was a strategic chose of respondents; they all had somewhat strategic positions within the company seen from a distribution point of view. The respondents interviewed were all involved in the distribution network, either in their daily business or as part of the project team implementing the change in distribution. The interviews have been taken place continuously during the period for the work with this thesis.

The interviews with the respondents were done in a semi structured way with distribution as the overall topic. The respondents were asked general question about the three different parameters of logistic effectiveness in order to gather a broader picture of the company. In addition to the general questions the different functions were asked in depth questions about their specific area of the distribution system. The questions from the study are presented in the appendix.

3.5 Presentation of the findings and analysis

The study of Radi Medical Systems' distribution has been divided into three parts. The first two are based upon empirical data and the third is more focused upon analytical discussions around the work with distribution systems.

The first stage was to evaluate and map the present distribution as it was in the summer of 2007. This work was mainly to formalize the structure and to clarify the performance of the system.

In the work with the second part the situation was different. The shape of the system was not embedded in the daily business at the time for the thesis. This part was therefore build up in close relation between the empirical precondition and the theoretical framework. In this part no consideration has been taken to whether the processes have been implemented or not at the time for the finalizing of the thesis.

The last part has addressed the question on how the next generation of distribution could be approached by a company like Radi Medical Systems. The visions and recommendations were made general so they can be interpreted into several companies fulfilling similar preconditions. This part was not based upon the case study company in the same extend as the previous two were but has a strategic approach to the concept of distribution.

3.5.1 Analytical framework

In order to achieve comparability between the three stages described above the term logistic effectiveness was introduced. With the base in Lumsden's discussions around logistics effectiveness this thesis has adopted three parameters as analytical support for the three stages described above. One part of the theoretical work has been to adjust the parameters

to a distribution context instead of the broader logistic context. Instead of answering the question of how logistics can have an impact on the profit of a company they should answer how distribution can do the same. The three constructs used are therefore Distribution cost, Tied up capital and Customer service. These constructs has been used to classify the empirical findings from the study. By the use of the categorization a comparison between the different types of distribution has been enabled. The table describes how different empirical findings has been classified and sorted into the constructs.

Distribution cost	Tied up capital	Customer service
Handling cost	Level of inventory	Availability
Transport costs	Goods in transit	Lead time
Cost of control		Information to customer

Table 2) Categorization of the three constructs from the logistic effectiveness theory. An explanation of how the empirical findings will be sorted by the three constructs. (own production)

In the actual case study these were the areas covered and researched in detail for the different stages of distribution. In the realization of distribution cost focus was upon how high the cost for personal in the process of distributing the finished goods from the time it was released from production until it has reached the final customer. Another important question to answer was the cost for the mode of transportation for the different distribution systems. Finally the administrative work in the process was studied, time for control of shipments and verifying of data in the ERP-system for example.

In the area of tied up capital the focus was upon how much goods was held in stock at different locations. These numbers were then multiplied by an estimated cost for each product in order to give comparability between different products and different stock locations. The time goods spend in transit has also been highlighted throughout the complete distribution system.

Within the area of customer service observations were made around availability of goods, time from customer order to delivery, feedback to customers. The availability of goods was important in order to secure the delivery of goods to customers. In order to provide a high level of service the lead time from a customer placed an order until the goods were delivered was monitored. The access to customer information was also studied in the different distribution systems i.e. the possibility to keep the customers informed about the deliveries.

With these three logistic effectiveness constructs as a base the different distribution systems were studied. How the distribution systems interact with the three constructs and what concequnces a change in distribution system brings to the logistic effectiveness. The three stages of distribution has also been analysed in respect to the theoretical discussion around

distribution stages. The table presented in type 2 (chapter 2.3.2) can be referred to in terms of logistic effectiveness. Abrahamsson et al has found decrease in costs and inventory along with the improvements in the area of customer service in their study of a centralized distribution system. The theoretical framework has been helpful in order to classify the different platforms for distribution and the case study has also worked to ratify the conclusions from the theories.

The final discussion has been formed by the theoretical framework as a base. The type 3 distribution system has highlighted areas where a future distribution system will have a great impact. These areas have thereafter been evaluated in terms of the logistic effectiveness criteria used in the previous evaluations. With these pillars as a starting point conclusions on how to improve distribution systems has been drawn in order to stay competitive.

4 Case Study – Radi Medical Systems AB

This chapter will give an introduction to the company where the study has taken place. It will outline and describe the parts involved in the distribution system at Radi Medical Systems. It will also present the distribution system used by Radi Medical Systems during the period prior to the work with this thesis. After the introduction to the system the three theoretical constructs, distribution cost, tied up capital and customer service will be addressed. The chapter ends with a reconnection to the theoretical framework and discussion of the findings.

4.1 Introduction to the company

Radi Medical Systems AB is medical device manufacturer. The base and headquarter for the company is situated in Uppsala and their products are used by hospitals and clinics. The company has nine subsidiaries worldwide serving their local markets. Radi Medical Systems core value is build up around medical solutions which make the patients' situation easier and their recovery faster. The two main areas are intravascular analysis and hemostasis management, within these fields Radi Medical Systems develops their products.

The core products in Radi Medical Systems portfolio are all made within the company. The production stretches from mass production of plastic arches via labour intense assembling of special wires to individual assembling of monitoring products. When products leave the production phase they have to be registered in the ERP system and released for further distribution. At this point the products enter the stage of finished goods and become a part of the distribution system.

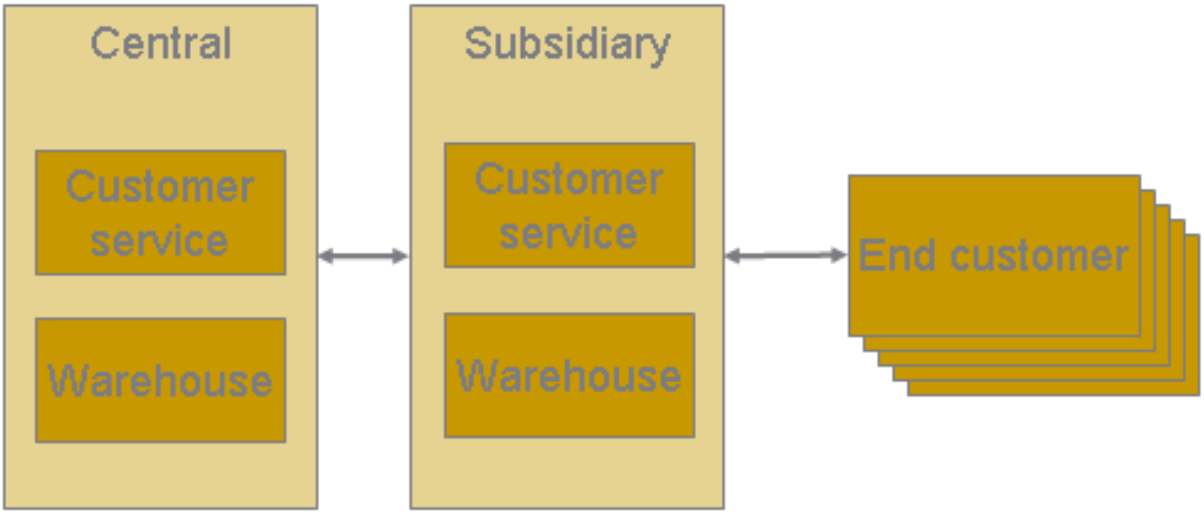

Figure 1) The different parts of the distribution system are visualized above. (own production)

The actors involved in the distribution system in Europe are pictured above. It contains central and local warehouses, central and local customer service departments, transport carriers and end customers. The warehouses are the different stock areas around the distribution system handling shipping and receiving of goods and inventory management in terms of for example verifying the quantities of goods in the ERP system. The central warehouse is located at the head quarter in Uppsala and the local are by the different subsidiaries around Europe. Customer service also has local departments at the subsidiaries and a central function at the head quarter. The tasks for the customer service include customer order processing, customer care and replenishment of goods. Transport carriers include all the carriers involved in the process of passing the goods from the central warehouse to the end customers, visualized by the arrows in the figure above. The end customers are spread out over in hospitals and clinics performing patient care involving Radi Medical Systems' products.

The customers have two different ways of receiving products from Radi Medical Systems, either through the sales representatives from the company or from certified distributors. The sales representatives are working directly for Radi Medical System, either in Sweden or at a subsidiary. The sales representatives are introducing and promoting the products at hospitals and clinics. After the sessions doctors and nurses decide whether to use the products and thereafter place an order which ends up in the customer service department at a Radi Medical Systems office. Certified distributors are marketing the products where there is no presence of a Radi Medical Systems company. They have their own chain of distribution not discussed in this thesis.

4.2 Distribution system with independent subsidiaries

During the early fall of 2007 the distribution to the end customers in markets related to Radi Medical Systems European subsidiaries was mapped. In the figure below the different European subsidiaries are pointed out. The subsidiaries and the distribution system have evolved organically over the years. The first subsidiary was established in the early 1990s' in the Benelux region and the most resent was the French establishment in 2007, in between the Swiss, UK and German office were opened.

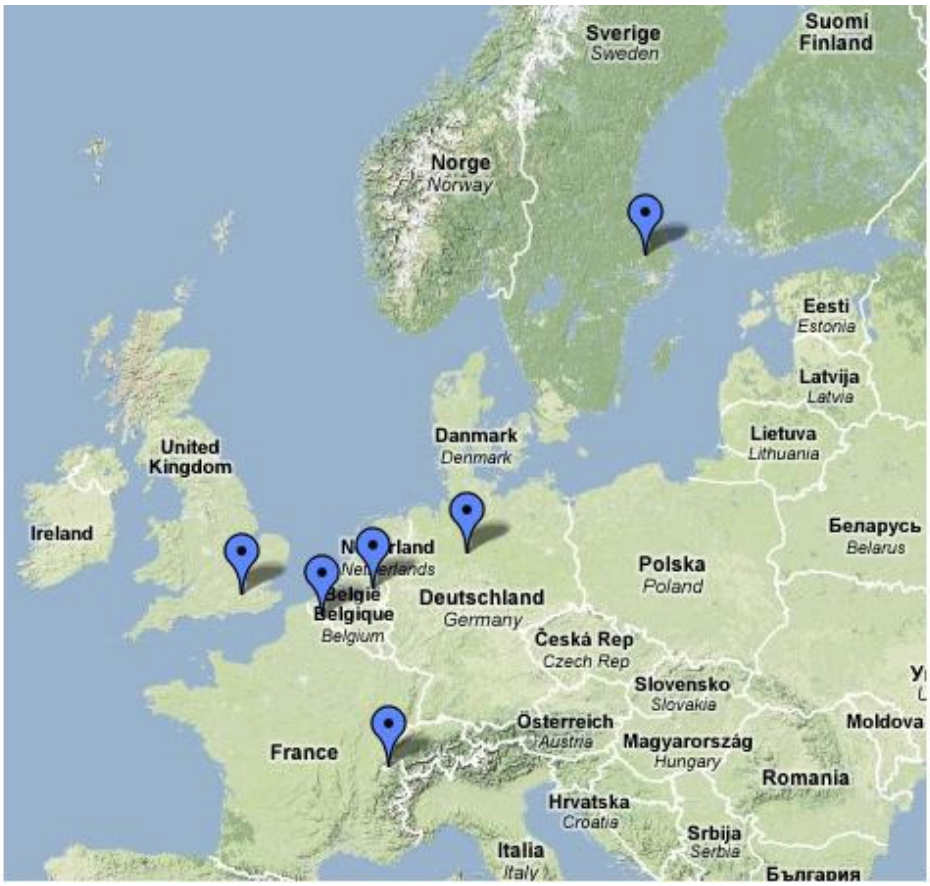

Figure 2) The European structure for distribution. Each of the markers points out an independent warehouse and subsidiary besides the marker in Sweden which is the headquarter. (source: maps.google.com own adoption)

In order to visualize the distribution structure of the distribution system used at the time by Radi Medical Systems the following scheme is provided.

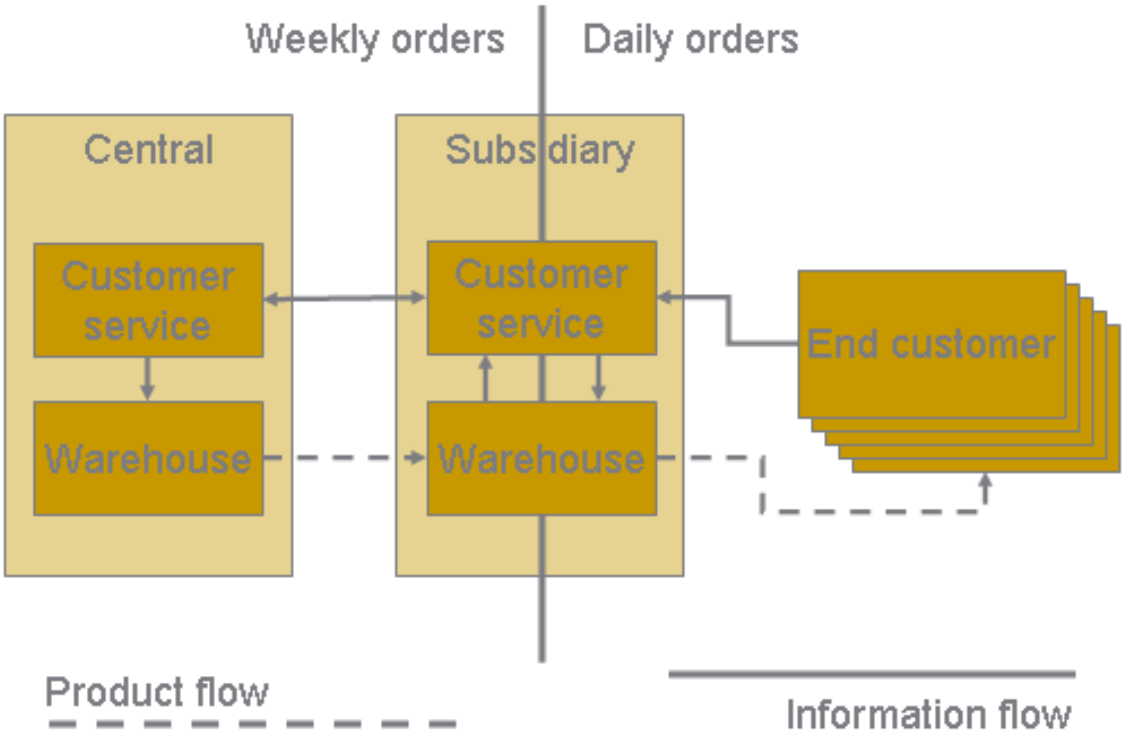

Figure 3) In the figure above the two different flows occurring in the present distribution system is outlined. The first is the weekly flow between the central warehouse and the subsidiary and the second is the daily orders from the end customers to the subsidiaries. (own prodution)

Above are the rough lines in the distribution system presented, the following chapters will elaborate further around different areas in the distribution system.

4.3 Distribution costs

The subsidiaries are as mentioned above managing their own inventory in local warehouses to support the customers. As can be seen in figure 3 above the subsidiaries receive weekly shipments from the central warehouse in Uppsala in order to replenish stock sold during the last week. From the time of an order it takes approximately 3 – 5 days before the goods arrive at the receiving site in Europe. When there is need for a faster delivery the subsidiaries can place orders for overnight shipment from the central warehouse to their site. The reasons for express shipments vary; it can be mistakes in the order or shipping process, it can be a sudden increase in sales of one product or it can render from shortage of goods at the central warehouse. In a shortage situation the goods might not have been available when the weekly shipment left the central warehouse and needed to be submitted afterward. All the orders from the subsidiaries are handled by the customer service department in Uppsala. They control the availability of the ordered products in the ERP system and then submit an order to the warehouse to pick and pack the goods to the subsidiaries. When the goods are packed a carrier brings it to the subsidiaries.

The subsidiaries thereafter have to receive the goods both in their local warehouse and in the ERP system. The receiver makes sure that all the ordered products were delivered to the subsidiary in the right quality and quantity. In the local warehouses they also monitor inventory levels in order to ask for replenishment and to verify the stock levels in the inventory with the stock levels showed in the ERP system.

The last step in the distribution chain is the daily orders from the end customers arriving in the subsidiaries, the right part of figure 3. This includes order receiving, picking and packing of goods, booking of shipment and finally invoicing. The subsidiaries use staff to monitor and perform theses tasks. The subsidiaries use local carrier solutions with an independent contract; some perform parts of the deliveries on their own with salesmen. The majority of the freights are paid by Radi Medical Systems, both the one to the subsidiaries and the one to the end customers. For a brief overview of the transport cost see appendix 2.

4.4 Tied up capital

With the present distribution system used by Radi Medical Systems there are six separate stock locations within Europe. The central warehouse in Uppsala is one and then each subsidiary has their own. All the stock locations have the complete assortment of Radi Medical Systems' products available in inventory, the levels vary with the demand in the specific market. The central warehouse has goods both to support their own direct customers and to supply the subsidiaries with refills on a weekly basis. The subsidiaries on their hand carry inventory in order to support their local demand. In addition to the goods being sold to customers each warehouse has to carry an extra safety stock in order to protect the business from unexpected variations in customer demand or supplies. In the present distribution system it takes several weeks for a product from being released as finished goods until it reaches the end customer, for figures see appendix 2. During the whole period capital is being tied up by the goods.

Another place, beside the warehouses, where capital is being tied up is during the transports around Europe. In the weekly shipments to the subsidiaries and in the shipments to the customers the goods are tied up in terms of capital. The weekly shipments to the subsidiaries are lasting for approximately 3-5 days depending upon where in Europe they are heading. The shipments from the subsidiary to the customer are regularly over night which means another day in transit for the goods until they reach a payer.

4.5 Customer service

The availability of stock to the end customers is set by the level of inventory at each subsidiary. The individual subsidiaries have their own inventory and thereby the possibility to supply the customers when they order. When the central warehouse has sent out signals that there is a low level of inventory of one product some subsidiaries fear there own customers availability. The subsidiary then places an extra order of the specific product in order to secure the availability on the local market. The possibility to arrange shipments from one subsidiary to a customer in a different country is not available.

In terms of lead time from order to delivery the present distribution system response to the customers came within the upcoming days. The standards were order day one and have the delivery day two or three. There were some variations between the different subsidiaries in this question, some with a direct response and some with a response after some days. The carriers chosen are though in general delivering the day after pick up.

In order to access tracking information about goods sent to customers the following scenario is picked from the Uppsala facility. When a customer calls with a question about a shipment the customer service first has to find the specific order number sent to the customer. Thereafter the warehouse has to be consulted in order to find the tracking number at the specific carrier for the shipment. Next step in order to find out where the goods is customer service calls the carrier in order to find out where the goods has gone. The final step is to get back to the customer with the information about the goods.

4.6 The current distribution system is a type 1 system

The distribution cost is as the theory states divided into different areas, transport, administrative and cost for control. Regarding transport costs the goods are handled by two different carriers on their way to the end customers. The first is dealing with the larger weekly shipments from the central warehouse to the subsidiaries and then the package distribution to the local customers. The extended process of shipping goods to the subsidiaries leads to a need for both handling and control at the different sites where the products are stored on their way to the customers. This involves a need for local personal to handle the work that has been done prior at the central warehouse e.g. packing, shipping and administration. The transportation agreements are all closed on a local level with no coordination in aspects of better price with higher volume with one common transport company at several subsidiaries.

This system results in that a product that is released as finished goods at the central warehouse first has to sit on the shelf in Uppsala meanwhile other products are being distributed to subsidiaries or direct customers. The products forwarded to the subsidiaries then sits on their shelves until it will be shipped to the end-customer. This increases the time from when a product is released as finished goods until it reaches the customer. The central warehouse also has to carry enough inventories in order to meet the size of the weekly orders received from the subsidiaries without running out of stock. The same applies to the subsidiaries that have to hold an individual safety stock in order to protect the business from unexpected events at each stock location.

The quick response to customers is based upon the availability of goods in stock at the subsidiaries and generates a short lead time from an order until the goods is delivered. If a product is out of stock at the subsidiary it has to be reordered from the central warehouse which causes an extra delay to the customer. This is not frequently happening but is occurring. When a new product is about to be released to the market the introduction takes time since the product first has to be distributed to the subsidiaries before it can be delivered to customers.

The system for tracking information of goods disables the possibility for personal to work proactive towards the customers. Since the work needed for tracking of goods is extensive it is not carried through without a reported problem from a customer. This leaves no possibilities to react and prevent delays to occur, for example by resending goods or complete missing papers.

The distribution system of today at Radi Medical Systems has much in common with the type 1 distribution system described by Abrahamsson et al. Both parts describe a distribution structure with several independent subsidiaries around Europe managing their own inventory. The subsidiaries have a high level of sovereignty with independent transportation solutions locally. Local levels of customer service are also a part which has to do with the sovereignty of the local subsidiaries.

5 A European direct distribution system

This chapter follows the same disposition as the previous one but addresses the centralized distribution system. First an introduction to the system followed by the three constructs of logistic efficiency and finally a part discussing of the findings from the direct distribution in relation to theories and the previous distribution system.

Hereunder a new distribution system for Radi Medical Systems will be outlined. During the period for this study the implementation of a new distribution system has proceeded. Even though the change has not been completed at the point when this report is written this thesis includes all planned measures regardless if they are implemented or not.

The core change in the distribution system is the introduction of direct distribution from a central warehouse to end customers within Europe. The subsidiaries will no longer be sending goods to the end customers with this system in place. Instead all products will be prepared, packed and shipped from the central warehouse in Uppsala where all the products are being released from production. The choice of Uppsala as central warehouse is based upon the situation in the product flow as it is today without respect to where the end customers are placed. A move of the central warehouse to central Europe did not fit into the scope of the project but is discussed under recommendations for further studies in this thesis.

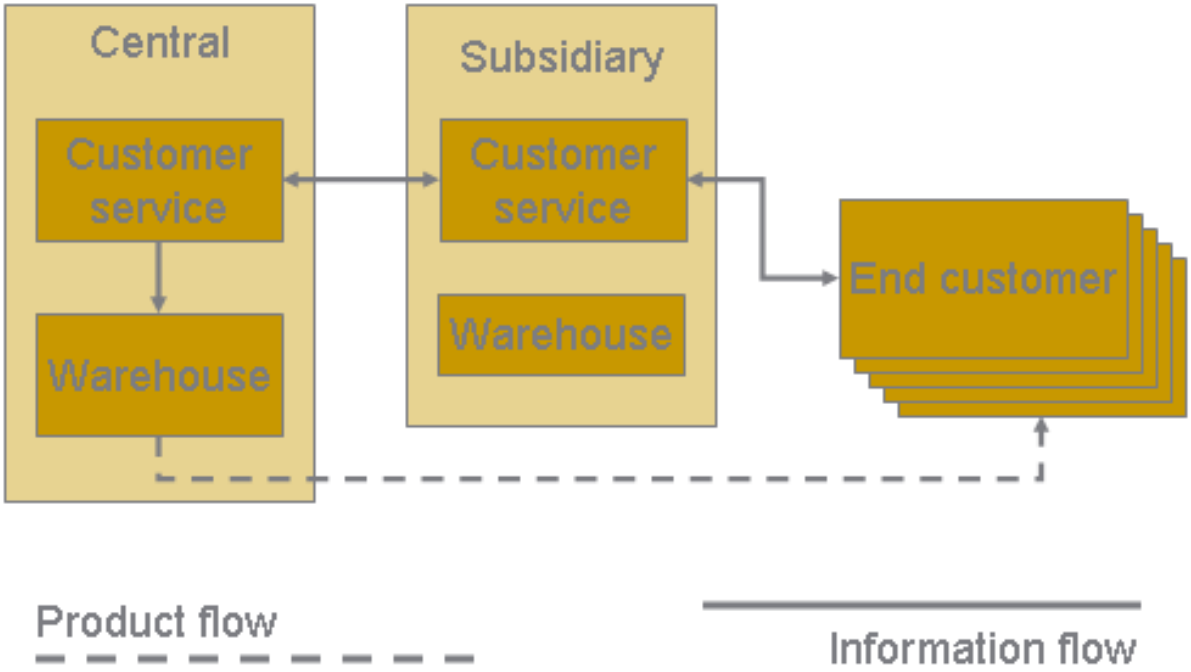

Figure 4) The picture above describes the changes in information and product flows that comes with the new centralized distribution system (own production)

The customers will place the orders as they have been doing at their local subsidiary. The local customer service department thereafter registers the orders into the ERP system. Simultaneously with the order entry at the subsidiary the information is to be found in the ERP system at the central customer service department. The central customer service department thereafter process the orders and forward them to the central warehouse that pick, pack and report the goods. When goods are being packed the ERP system will automatically book a shipment and the goods can be labelled with a carrier specific label at the central warehouse. When the shipment is booked the goods also becomes traceable in a track and trace system. At the end of the day the carrier comes and picks the shipments for delivery two days later to the end customer in Europe. During the delivery period the goods passes several scanning points which makes it possible for Radi Medical Systems to trace the goods via a track and trace system. In the track and trace system the goods are visible until the packages are received by the end customer. Invoices and customer support will be handled by the local customer service departments who are administrating the contact with the end customers

5.1 Distribution cost

The distribution costs are affected by the change in different ways. A lot of the handling and administrative tasks are centralized and removed from or decreased at the subsidiaries. At the same time the first trials indicates an increased transport cost for the new distribution system in relation to the previous.

A central point in the centralization is the change it brings to the inventory handling. When the goods are shipped from the central warehouse the need for an extended inventory at the subsidiary disappear and floor area will be released. The centralization of the inventory lowers the need for administration and control of inventory at the subsidiaries e.g. the receiving and shipping of goods and the ERP administration of the inventory will not be performed at the subsidiaries to the same extent. These functions will in some cases increase at the central facility and in some cases be removed from the distribution system. In all the administrative tasks the total amount of work will decrease due to economy of scale at the central warehouse. As example the need for administration of goods won't increase since there will be the same amount of goods to handle at the central warehouse when the subsidiaries are removed from the distribution chain. The administrative work at the subsidiaries will though be removed and therefore release for other tasks.

The process of booking shipments will be automated and the administrative work will decrease at the central warehouse. The shift from manual booking of each single shipment to an automated process reduces the workload per booking. At the central warehouse the handling of goods will be affected by the changed distribution system as well. The same amount of goods will pass through the central warehouse but the size of the shipments shift. From large weekly orders to the subsidiaries to smaller orders direct to end customers handled on a daily basis.

Regarding the transportation cost the central distribution will be more costly compared to the decentralized structure used prior. The cost of transportation in the previous system was

build up by two steps of distribution with one part from the central warehouse to the subsidiary and then a second transportation to the end customers within the local market. In the new system there will only be one carrier all the way. The first figures from transport companies indicate an increase in transport costs in comparison to the earlier system as provided in appendix 2.

5.2 Tied up capital

The new distribution system have several implications on the tied up capital in the company, shorter time from a product is released until it reaches the end customer, lower inventory levels in the whole distribution chain and less time for the goods to be in transit. For figures see appendix 2.

In the new system the products are distributed directly to the end customers without being handled by the subsidiaries. As a consequence the time from a product leaves the production until it reaches its end customer can be shortened. The distribution system allows the inventory placed at the subsidiaries to be centralized but with a small amount left at the subsidiaries in order to support the customer service. The elimination of the subsidiaries also provides the central warehouse with the end customers orders instead of the larger orders from the subsidiaries once a week.

The second part of tied up capital is the goods in transit. The amount of goods in transit will decrease when the products are being shipped only once instead of twice as it was in the previous system. The new distribution have only one or two days in transit for each product compared to prior when the goods could be four to six day in transit adding the weekly orders to the subsidiary and the final distribution to customer from a local warehouse.

5.3 Customer Service

In order to keep a high customer service towards the end customers the interface between them and Radi Medical Systems remain at the subsidiaries. To keep the local customer service department efficient the use of the ERP system is a crucial component. In the new distribution system the customer place their orders in their local language with local customer service department. The next step thereafter is to enter the order into the ERP system which transfers the order information to the central customer service department. At the central warehouse all the administration is done and the goods are shipped to the end customer. Finally the invoice will be printed in the subsidiary office and distributed to the end customer locally.

The process described above with instant communication between the local and the central department is crucial for the time from order to delivery. When addressing this in the new distribution system a key issue is to keep the time from a package leaves the central warehouse till it reaches the customer as short as required. This time will determine the total time since the time from entering an order locally until it can be shipped is negligible in comparison to the transport time. In the implementation of this system the transfer time will be 24 hours for customer within the subsidiaries markets. A product picked up on day

one will be delivered within Europe before end of business the day after. In cases not foreseen the subsidiaries will initially have a small inventory to solve problems that has needs immediate action.

The process around tracing of packages will be improved in the new system. With an online track and trace system connected to the carriers chosen for the different deliveries. The customer service departments all around Europe will have access to the system and be able to trace their local shipments without support from the central warehouse.

5.4 Direct distribution in the light of the theoretical framework

As mentioned in the opening of this chapter the core issue for the new distribution system is to centralize the end customer distribution. This part will discuss the consequences from the findings above in relation to the theoretical framework. It includes both the three constructs of distribution effectiveness, the theories around type 2 distribution systems and the relation to the earlier distribution system outlined in the previous chapter.

The main reason for the decrease in distribution costs in the new distribution system is reductions made at the local departments. With more and more tasks such as administration and control done only once and in larger scale the cost per unit will decrease. As an example will the number of persons and tasks around one package decrease with the direct distribution from a central warehouse. In the new system the goods will be released from production in the ERP system and placed in the central warehouse. The next step for the product is to be packed and shipped directly to an end customer in Europe. Not to a subsidiary with the administration and control occurring along the way in order to be stored a second time and then finally shipped to the customer. These benefits will gain in importance with the time and the expansion of the company. The areas needed today for storage and handling of goods will not have to expand due to increasing sales.

Abrahamsson et. al. are in their paper describing how the transportation costs will decrease with the centralization of the distribution. This is not the case in the case study company where the cost for transportation will increase with the new distribution system. In the decentralized system the transportation cost has been the focus for the distribution cost and the administration and handling has been overseen and in the introduction of a new system the transportation costs are getting higher. This might lead to some arguments whether the distribution cost is decreasing or not and therefore a broader perspective of distribution costs has to be introduced.

The levels of inventory will decrease with the new distribution system as foreseen by Abrahamsson et al. The reduction in inventory with a central warehouse derive from several reasons; shorter time from a product leaves the production until it reaches the customer both in warehouses and time in transit means that the goods does not have to be held in inventory for the same amount of time., The centralization of inventory brings all the safety stock together from the different warehouses, the level of safety stock can then be lowered since they are not needed anymore. A third rational behind lowering the inventory levels is when the order sizes leaving the central warehouse will switch from weekly subsidiary orders to daily customer orders the amount that need to leave the warehouse at

the same time decreases. With that decrease comes that the inventory levels does not have to take the big orders into consideration and can therefore lower the levels.

In terms of customer service the change in distribution system has had a positive impact on the availability seen from the whole group perspective, the same amount of products will be able to supply the customers better when they are gathered at the same place. When it comes to the lead time for the customers the new system has been able to maintain the lead time which means placing an order day one means delivery day two or three. The third customer service parameter is the feedback to customers which has improved a lot with the new system, due to the online track and trace system the goods sent to customers can be traced and monitored continuously from both the central and the local customer service departments.

There is a high correlation between the European distribution system for Radi Medical Systems and what the theoretical framework refers to as type 2. The theory states that a good information system is crucial. Since the case study company had their global ERP system in place this was not an issue but clearly the new distribution system would have been much harder without the possibilities of the ERP system. As can be seen in the above most of the foreseen results within the constructs of distribution effectiveness are fulfilled

6 The evolution of distribution system

This chapter summarizes the two stages of distribution discussed above and outlines a strategy on how to improve the distribution system further. The strategy is divided into internal and external changes with the common goal to generate income to the company through logistical changes.

The type 3 distribution system differs from the two earlier in the sense of not having the same impact on the standard distribution pattern. The switch from type 1 to type 2 was focusing on the change in the physical distribution. The type 3 is based upon the earlier stages in the sense of physical distribution but changes the thinking in what distribution and logistics are there for, from a cost reducing to an income generating department. There are several approaches in the literature how to achieve this change. In this thesis the changes have been divided into internal and external changes as presented in the figure below. The core of the changes is the new focus on increased income. The internal changes have to be done in the organisation and the external changes are focusing upon the external relations e.g. the customers or the suppliers. In the upcoming parts the different changes are discussed and related to each other in order to build up the understanding for them. As an introduction to these changes a discussion about the switched focus on increasing income is presented in the next paragraph.

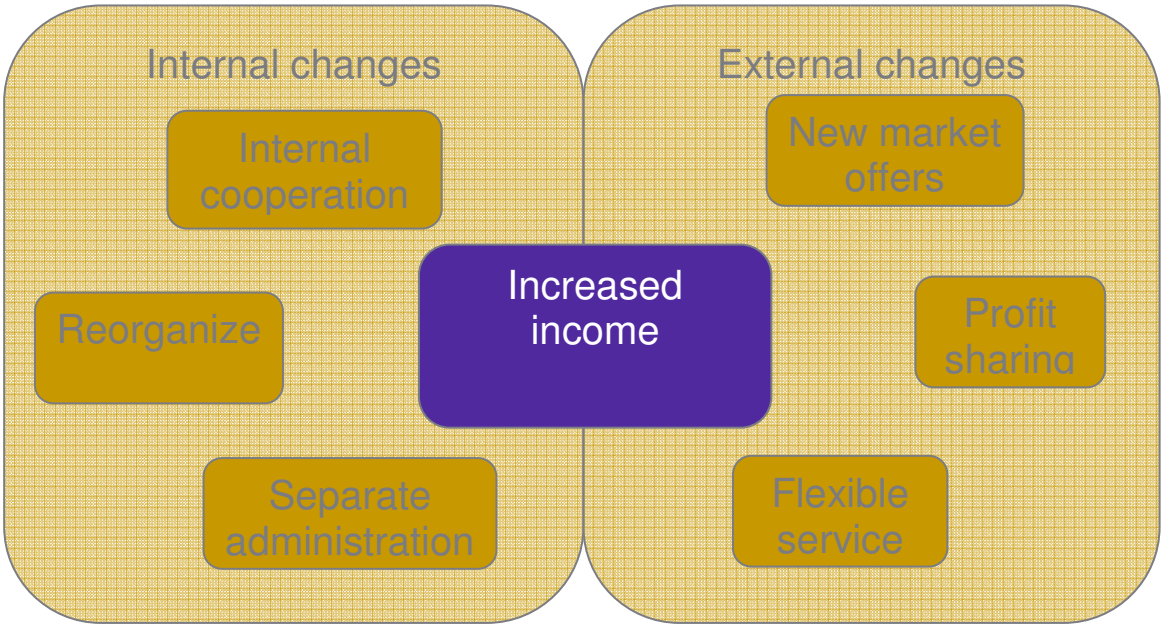

Figure 5) The figure shows the different changes discussed in the theories of type 3 distribution systems. The elements are categorized into internal and external changes with the common goal to increase income. (own production)

6.1 From decentralized distribution to an income generating focus

The over all focus for future logistical work in general and for distribution system in particular is to become an income generating department instead of a cost reducing unit in a company. From the previous chapters the reader has been introduced to two different distribution systems. In chapter 4 the decentralized system that performed distribution of the goods with the focus on as low transportation costs as possible combined with high accessibility to the goods, solved by short geographical distance between the warehouse and the end customer. The tied up inventory is not an issue that is dealt with in this system. It contains a level of sub optimization when each subsidiary is trying to bring meet their customers needs as good as possible. The customer service is focusing upon the availability of the goods locally and thereby the possibility to deliver goods to the end customers as fast as possible. The system presented in chapter 5 has compared to the previous distribution system a broader approach towards the different logistic effectiveness parameters. The centralization brings reductions in both handling and administration of the goods. The transportation costs are though increasing in the centralized distribution system initially. The centralization also enables an increased focus on the tied up capital with most of the inventory stored and managed centrally. Regarding the customer service the new system has to prove that the delivery performance is in relation with the decentralized structure in terms of lead time while the availability and information to customers will improve. On the whole the centralized distribution system has a focus on reducing costs while obtaining and improving the customer service.

In the work with a future distribution system the transition towards income generating products and concepts has to be taken in consideration. One way of achieving that is as Ballou stated in the theoretical framework to work with customer service. The work with a new distribution system will therefore not focus upon the distribution costs or the tied up capital but on the customer service. Hereafter follows a deeper description of the different changes that has been identified in relation to the new distribution system.

6.2 Internal changes

The three internal changes brought up by the literature were increased cooperation, reorganization and separation of administration. These are all concepts that involve a company's internal organisation. Increased cooperation refers to an increased involvement from the distribution and logistic department earlier in the process. Instead of being the one that executes decisions made by RnD or marketing logistic should be involved in the shaping of the decisions. One example can be the package for a new product, an area where all parts have an interest in the outcome of the question but they all carry different reasons and rationales for their opinion. One could be the purchasing pattern of the customers. Shifting them towards buying more and more pre packed sizes the price can be lowered. When customers order in a pre packed box the amount of work needed to make the goods ready for pick up decreases. The engineers can thereby construct the package so that the goods are well protected. A closer cooperation in questions like that will be in favour for the company as a whole. In order to facilitate cross-functional cooperation in the company

the function handling the distribution question has to be raised to the same level as RnD, Marketing and Production in the organizational scheme. By reorganizing the structure of a company top management has closer connection to the logistic questions and at the same time adding importance to the function by lifting it up in the organization.

Separation of administration was the last issue that was raised by the theories in order to improve the distribution system. By separating and thereafter also centralizing the administrational work economy of scale benefits can be achieved by standardized processes and high utalization. In the case study company described above parts of the administration was left decentralized at the subsidiaries. The rational behind this was to keep the interface towards the customers in the local environment and language. A total centralization of administration requires a more neutral customer contact than the case study company was showing up. The use of internet as interface towards the customers is one step that simplifies a centralization of the administrative work.

6.3 External changes

The changes presented as external changes focus on participants that belong outside the company even though they origin within the company. The external changes all contribute to the common goal to increase the income of the company. The introduction of new market offers is referring to the work within the company to present new offers to the customers with focus on logistic or distributional services. New logistical solutions supply the marketing department with new possibilities. The new solution then has to be charged either in increased price or as a marketing cost resulting in a competitive advantage. One example is the possibility to have direct distribution in the US from a warehouse in Europe. With daily flights in the early evening across the Atlantic Ocean the goods can be distributed the next day to US customers. From order to delivery it takes two working days for a customer in the US to receive goods from a supplier in Europe This change might not be used as a distribution system for US customers on a daily basis but the possibility enables reliable transports across the Atlantic Ocean for special occasions. The transport costs and the environmental impact will increase with a daily distribution across the sea. In terms of support the time difference makes it more difficult but since the online track and trace possibility exists the information is always accessible. Another change presented in the theoretical framework was the increases in the individual adoption of service to different customers. The basis is that all customers do not request the same level of service, some need short lead times and some have planned for longer. With help foremost from computerized solutions individual customer adoptions are easier to implement and monitor now.

The last change with sharing of profit connects to the picture of the whole supply chain, incomes generated at one point in the supply chain has to be spread out to the parts contributing to the increased profit. By doing this all the participants in the supply chain will be more interested in changing their behaviour in order to reduce cost somewhere else. This can be visualized by giving customer a discount if they place standing orders to a company. With standing orders the planning of the production can be made easier which

gives less inventory. Also the warehouse has can plan their work better. By knowing the orders in advance a more cost efficient shipping alternative can be chosen as well.

7 Conclusion

This thesis shows an evolution of distribution system over time both in terms of theoretical assumptions and from the case study company. In the paper one can follow the development from a stage of distribution with individual subsidiaries handling their distribution and inventory management locally. Thereafter follows a centralization of the distribution which brings direct shipments from one warehouse to the end customers. By handling the goods at fewer points in the supply chain economies of scale are build in to the distribution structure. The third stage describes a distribution system with an increased focus on customer service. By increasing the focus on the customer service the logistic department will be able shift from a cost saving function into a profit generating one.

Within the decentralized system of distribution the level of independency within the subsidiaries caused tied up capital to grow since each subsidiary kept their own inventory. It also brought low flexibility to the system when inventory piled up at some places while others were lacking the same product. The subsidiaries also encountered high cost in personal by adding work to the goods without adding value as their local warehouses administrate and handle the products a second time. In terms of customer service the customers most of the time had a quick response from the company but with limited access to tracking information.

In the centralized distribution system most of the foreseen implications from the theoretical framework was fulfilled as far as the case of Germany shows. The levels of inventory and capital tied up decreased when the centralization was implemented. The cost for transportation though increased in contradiction to what the theories stated, here the placing of the central warehouse has an important role which is discussed in recommendations for further studies. On an overall perspective the distribution costs were kept on a similar level since the subsidiaries free time from inventory management for other tasks and free up space from the local warehouse. In terms of customer service the access to tracking information has increased the possibility to work proactively when a shipment is missing. The time from customer order to delivery is by the direct distribution flexible and can be 1 - 3 days depending on the customers need. These conclusions will most probably also apply on the whole case of Europe since the pre conditions are similar as described in the previous chapter with the same set up for local distribution at the different subsidiaries. Exceptions might be for distribution to UK and France where the distribution time will be longer since the distance from the central warehouse increase. That applies to the economy alternative meanwhile the express solution will be overnight in all European countries.

The third stage addresses the high transportation costs with flexible lead time solutions with the customer. Teaching the customers to order in advance will allow a company to plan the transports in a more extensive way. In the case of Radi Medical Systems the place for the central warehouse should be evaluated as discussed in further studies as well. The tied up capital will not change dramatically compared to the level in type two. The big improvement will be the level of customer service that will be enabled in the third stage of distribution. Within customer service an increased holistic view of the distribution will be needed in order to provide more opportunities to generate income from logistic solutions.

The changes found in relation to the implementation of the third stage of distribution were both internal and external in relation to the company where they are implemented. Internal changes such as reorganizations and increased cooperation were supported by external changes such as new marketing strategies and profit sharing within the supply chain. The overriding target is to create an income generating logistic department within the company..

7.1 Thesis results in a broader context

In order to validate the study and the conclusions made in this paper a follow up on the new distribution system at Radi Medical Systems within some years would be appropriate. An area of extra interest for follow up would be the cost for transportation additional described in the recommendation for further studies. Regarding the generalisation of the findings from this study the ambition has been to create a work with ideas for a broader public than the case study company only. The thesis can be described as consolidated thoughts from different views and then presented in this paper. The outcomes are applicable to other industries and companies sharing similar pre conditions as the case study company initially had. Or if a company operates a direct distribution system the results from the discussion about becoming an income generating logistic department can be of interest and worth considering.

In order to achieve a reliable and trustworthy product different opinions have been taken in consideration in this thesis. Both in terms of cross checking data and information from multiple sources in order to reach a higher level of reliability. This applies both to the actual raw data in terms of transport times and handling costs where both the central and the local departments were questioned. And also to the strategic level of distribution system rework in chapter 6 where different inputs were adopted, from theories, experiences and also other distribution experts.

7.2 Recommendations for further studies

The thesis indicated, in contradiction to the theories by Abrahamsson et al., an increase in transportation cost when the distribution switched from a type 1 to a type 2 system. This question needs to be further elaborated and tested in order to bring increased knowledge to the case. One possible reason might be if there were constraints set in the theoretical study that were not met by the case study company, such as positioning of the central warehouse. A broader study from different industries would be interesting in order to highlight how different prerequisites in different branches affect the logistic effectiveness in general and the transportation cost in particular. Beside the transportation cost the other effectiveness parameters can be monitored in order to secure the usefulness of the new distribution systems. By the time of publishing this paper the investigated parameters all follow the directions discussed in chapter 5.

Other possibilities for the case study company to improve the direct distribution system would be to consider the location of the central warehouse and to investigate the customers' sensitivity to delivery time. In terms of where to place the central warehouse calculations based on the flows in and out from the warehouse would be interesting. In order to place the warehouse at a geographically optimal location both incoming and outgoing flows has to be taken into consideration. Another area which would improve the performance of the direct distribution system is to look further into whether customers need all products with the same delivery time or if some could be shipped in a more economic way. Questions to be raised is what delivery times are expected from the end customers and in different regions and for different products.

Another area of interest that were observed during the work with this thesis was the how an increased cooperation between different parts of the healthcare supply chain can be achieved. In this thesis no direct information has been gathered from the end customer of the product. Neither the healthcare professional nor the patient who are treated by the products are discussed in this thesis. None of the suppliers of material for the products has been involved in this thesis. By expanding the focus from distribution to a broader perspective a study would gather interesting information that would be useful in the work for the future distribution system. As can be seen in the sixth chapter about income generating logistic department there might be a need to involve more actors in the supply chain in order to avoid sub optimizations in single processes.

A third area of interest for further studies is the shift of the logistic department towards an income generating department with close ties to both the marketing and the production department and a higher position in the company. Does this imply that logistic departments in the future will act as an intermediate between those two departments and in that role become a key actor for the companies in the future? The logistic department has natural connections to both sides and therefore has a great opportunity to become the key player with a holistic perspective. It is important to manifest this in order to avoid the logistic department from taking the role as a bumper between the two departments and the distribution work will be back in the type one again perhaps.

8 References

Abrahamsson, M. (1993) Time-Based Distribution. *The International Journal of Logistic Management*. Vol 4 no 2. 75-83

Abrahamsson, M., Brege, S. & Norrman A. (1998) Distribution channel re-engineering – organizational separation of the distribution and sales function in the European market. *Transport Logistics*, Vol 1, no 4, 237-249

Abrahamsson, M., Aldin, N. & Stahre, F. (2003) Logistic Platforms for Improved Strategic Flexibitlity. *International Journal of Logistics: Research and Applications*, Vol 6, no 3, 85-106

Ballou, R (2004) *Business Logistics/ Supply Chain Management5th ed.,* New Jersey, Pearson Prentice Hall

Ballou, R (2006) Revenue estimation for logistics customer service offerings. The International Journal of Logistics Management, Vol 17, no 1, 21-37

Ballou, R. (2007) The evolution and future of logistics and supply chain management. *The European Business Review*, Vol 19, no 4, 332-348

Jonsson, P. & Mattsson, S. A. (2005) *Logistik,* Lund, Studentlitteratur

Lorentz, H. (2004) Aktionforskning: om likheter och olikheter i användningen av och benämningen inom pedagogisk forskning. Pedagogiska Uppsatser no 37

Lumsden K.(2006) *Logistikens grunder,* Lund, Studentlitteratur

McKone-Sweet, K. E., Hamilton P. & Willis S. B. (2005) The Ailing Healthcare Supply Chain: A Prescription for Change. *The Journal of Supply Chain Management*, 4-17

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D. & Zacharia, Z. G. (2001) Defining supply chain management. *Journal of Business Logistics*, Vol 22, no 2, 1-25

Skjoett- Larsen, Tage. (2000) European logistics beyond 2000. *International Journal of Physical distribution & Logistics Management*, Vol 30, no 5, 377-387

Tracey, M (1998) The Importance of Logistics Efficiency to Customer Service and Firm Performance. *The International Journal of Logistic Management*. Vol 9, no 2, 65-81

Valcon (2007). Lean – ökad produktivitet, högre kvalitet och mindre stress, www.valcon.se (2008-03-12)

8.1 Respondents

Ingrid Djerfh, Customer Service Manager, Sweden

Gesa Engelbracht Customer Service Manager, Germany

Mats Engström, IT Director, Sweden

Mats Ericsson, Inventory Manager, Sweden

Inger Hållner, System Controlling, Sweden

Mark Hawthorne, Country Manager, Great Britain

Paul Kreutzer, Sales Manager, Germany

Huub Oomes, Country Manager, Benelux

Gustaf Rasin, Project Manager for the distribution project, Sweden

Stefan Sowa, Director Production, Sweden

9 Appendices

9.1 Appendix 1
Questionnaire

Can you describe your work in relation to distribution?

Distribution cost

How does Radi Medical Systems work with distribution?
- handling of goods (moving, picking, packing)
- administration of goods
- cost for transportation

Tied up capital

Where in Radi Medical Systems' distribution is the goods stored and for how long?
- For what reasons are they stored there?

Customer Service

What service does Radi Medical Systems offer to the customers?
- availability of the products?
- time from a customer place an order until they receive the goods?
- time from a carrier picks up the goods until the product is delivered?
- feedback to customers?

Future distribution system

What is your opinion about the future for distribution at Radi Medical Systems?

9.2 Appendix 2

Data sheet

Since the project at Radi Medical Systems introduced Germany first to the direct distribution the figures presented below shows the experiences from the German subsidiary along with the whole European market which is the final goal for the direct distribution. The figures for Europe are there in order to present a perspective of the scope of the whole project

Distribution costs

Compares the transport cost from 2006 with independent subsidiaries with transport cost for one year based upon prices negotiated for the direct distribution. The cost for independent subsidiaries includes both the cost from Uppsala to the subsidiary and the second leg from the subsidiary to the end customers. The direct distribution cost is based upon distribution directly from Uppsala to the end customers in Germany.

		Independent subsidiaries	Direct distribution	
	Radi Europe[3]	1 550 000 SEK	-	

Tied up capital

Compares the inventory level average over 5 weeks prior to the direct distribution with inventory levels average over 5 weeks when the direct distribution was implemented. The capital is calculated by multiplying the average number of products in inventory by a standard price for each product.

Customer Service

The figures compares the delivery time from the independent subsidiary with the service offered by the direct distribution. The independent subsidiaries have their customers closer to the warehouse compared to the direct distribution system where 2 days are chosen for cost reasons.

	Radi Europe[6]	1 – 2 days[7]	-	

[3] Includes the Swedish direct customers and the European subsidiaries
[4] Includes the Swedish direct customers and the European subsidiaries
[5] Does not include inventory in Sweden
[6] Includes the Swedish direct customers and the European subsidiaries
[7] Vary between different subsidiary' markets